DIATOMITE in NOVA SCOTIA

by

A.R. Anderson

INFORMATION CIRCULAR
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Cover Photo: Sampling a diatomite deposit, Digby Neck, Digby County.

Inset: Raw diatomite sample, New Annan, Colchester County.

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Nova Scotia Department
of Mines and Energy
Halifax, Nova Scotia
1988

DIATOMITE

Introduction

Diatomite or diatomaceous earth is a siliceous sedimentary material formed by the accumulation of the skeletal remains of microscopic plants of the class Bacillariophyceae, commonly known as diatoms. These tiny one celled plants are capable of removing soluble silica from their environment to produce opaline or hydrous silica cell walls or shells which, upon the death of the organism, settle out and accumulate to form thick beds of sediment. The diatom shells can range in size from 1-100 μm, however, the average is between 50-100 μm depending on species and growth conditions. One cubic centimetre of diatomite may contain as many as 6 000 000 shells.

These minute particles contain primary pores at regular intervals forming delicate lacelike structures which give diatomite its unique properties. The pores in the shells are very small (1-3 μm) in diameter and often many species have an even finer network of secondary pores (< 0.5 μm) within the primary pores (Plate 1).

Plate 1. Scanning electron micrograph of Nova Scotia diatomite.

The unique structure of diatomite particles (diatoms) and its chemical stability make it desirable as a filter-aid as well as a functional filler, extender, anticaking agent, antiblocking agent, mild abrasive or polish, chemical carrier and absorbent. Over half of the current diatomite production is used as a filter-aid in beverage industries, such as the clarifying of wine, beer and fruit juices and in water purification systems.

ORIGIN AND MODE OF OCCURRENCE

The diatomaceous sediments typically found in Nova Scotia are primarily of recent origin (10-15 000 years B.P.), occurring in many lakes and bogs throughout the Province. Deposits and occurrences are primarily found in small catchment basins within terranne dominated by plutonic, volcanic, or meta-sedimentary rocks. Weathering of the local bedrock and glacial drift releases silica to the ground water system where it is then metabolized by the tiny plants to form their cell walls which then accumulate to form diatomaceous earth. Deposits have been found to contain between 10-60 per cent organic content depending upon the depositional environment. Organic residues can be removed by drying and sintering leaving a very high silica content and varying amounts of alumina, iron, and alkalis resulting from included clay particles.

DIATOMITE IN NOVA SCOTIA

Most of the reported occurrences of diatomaceous earth are found in the Cobequid Highlands associated with the plutonic bodies of granite and granodiorite of Devono-Carboniferous age, and the Antigonish Highlands, in proximity to Devonian igneous plugs within older (Early Cambrian) felsic volcanics. Deposits of diatomaceous sediments in these regions tend to have less organic material indicating favourable conditions for abundant diatom production.

Deposits are also known to occur in the eastern and northern igneous terrane of Cape Breton Island. Occurrences found here are similar to those of northern mainland Nova Scotia. Significant deposits of diatomaceous sediments laden with organics are found in association with Triassic

basalt flows which make up the North Mountain, in particular along Digby Neck.

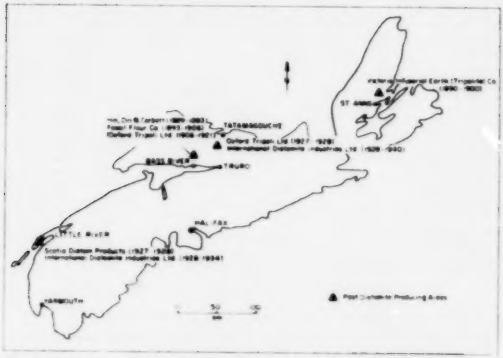

Figure 1. Past producers of diatomite in Nova Scotia.

HISTORY OF DIATOMITE PRODUCTION IN NOVA SCOTIA

Between 1921 and 1955 about 11 500 t of dry finished diatomite were produced from Nova Scotia mining operations (Fig. 2). Most of this material was exported and used in the manufacture of ceramics, rubber, polishes and firebrick. The majority of the production was from deposits in the Cobequid Highlands and Digby Neck.

A small amount of diatomite was produced from deposits in northeastern Cape Breton. The Vic-

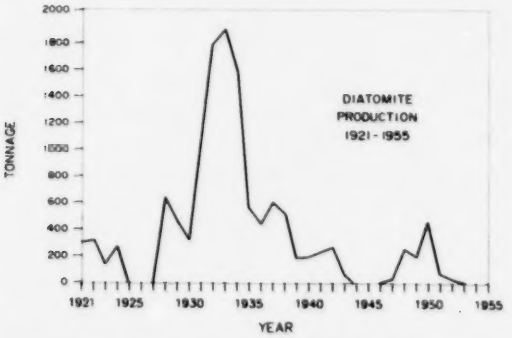

Figure 2. Diatomite production in Nova Scotia from 1921-1955.

toria Infusorial Earth Company removed diatomite from several small lakes in the St. Anns-North River area of Victoria County prior to the turn of the century. No diatomite is currently being produced in Nova Scotia.

ECONOMICS OF DIATOMITE PRODUCTION

Annual world diatomite production is about 1.8 million t with 1/3 coming from California, Nevada and Washington. The U.S.S.R., Romania and France are also major producers (Table 1).

The growth rate of diatomite markets is reported to be about 1 per cent per annum. The cost of shipping diatomite from west coast producers to east coast markets is about $110 U.S. per tonne and the average product value is $200 U.S. (f.o.b. plant) (Miles, 1987). A recent study of industries using diatomite in Atlantic Canada indicates the retail market value of this material is approximately $500-550 Canadian per tonne. Most of the diatomite used in Atlantic Canada is by the brewing and food processing industries as a filtration aid.

There is potential to supply some of the region's diatomite markets using Nova Scotia deposits. These include the use of diatomite as a pozzolan material in cement, as a chemical carrier, abrasive and in the manufacture of paint, paper and fertilizers.

Table 1. Diatomite production 1985*.

Country	Tons (000's)	Tonnes (000's)
U.S.A	635	576
Romania	331	300
U.S.S.R.	270	245
France	276	250
Others	439	398
Total	1951	1769

*U.S. Bureau of Mines.

Table 2. U.S.A. diatomite consumption, 1985*.

Use	%
Filtration	66
Filler	21
Insulation Products	1
Other	12

*U.S. Bureau of Mines.

MAJOR DEPOSITS OF DIATOMITE IN NOVA SCOTIA

Over 125 diatomite occurrences are recorded in Nova Scotia. Seventy-five of these have recently been investigated (Anderson, in prep.). The following deposits provide the best potential for development based upon resource quality and accessibility (Fig. 3).

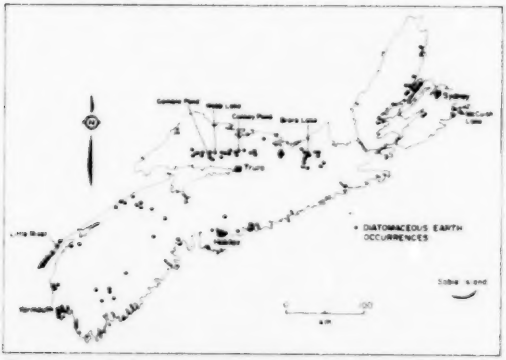

Figure 3. Diatomaceous earth occurrences in Nova Scotia.

Brora Lake, Pictou County

Brora Lake is about 5 km southeast of Middle Barneys River, Pictou County and can be reached by a woodland access road. The Lake is about 24 ha in size of which 16 ha are covered with diatomite 1-1.5 m thick. The diatomite is of variable grade throughout the Lake. The southwestern portion of the Lake (2-3 ha) has about 1 m of fairly dense off-white diatomite. The remainder of the Lake

is covered with a soft medium brown grey mud up to 2 m thick. Volume of material in the deposit is estimated to be 350 000 m^3 of which 20 000 m^3 is white grade.

Factory Bog, Digby County

Factory Bog is located southeast of Highway 217 near Tidville, Digby County. The bog is roughly 20 ha in size with up to 4 m of diatomaceous peat. On average the best reserves are found between 1-3 m in depth where 70 to 85 per cent diatomaceous material occurs. It is estimated that close to 400 000 m^3 of crude diatomaceous material exists in the deposit. Because of the high moisture content this equates to about 53 400 t of dry calcined product in situ.

This deposit was in production until the middle fifties and it is estimated that 5600 t of dry product was produced for markets in the Eastern United States and Canada.

McCuishs Lake, Cape Breton County

McCuishs Lake is located 4 km northeast of Highway 22 between Sydney and Louisbourg, Cape Breton County. The Lake is about 1 km east of Catalone Road. Access to the deposit is along a winter road to the northern edge of the Lake. The diatomite of the deposit is of variable grade. A substantial amount of dense white diatomite occurs in a ring around the perimeter of the Lake about 2-3 m offshore. The ring is not continuous, grading into soft grey diatomite in some places and varying from 20 cm to 1.5 m in thickness. The central portion of the Lake is covered with over 2-3 m of soft grey green organic ooze or gyttja, that has a fairly low diatomite content. McCuishs Lake is about 16 ha in size of which 11 ha is covered with diatomaceous sediment. The ring of grey white diatomite covers an area 6.5 ha with an average thickness of 30 cm. An estimate of in situ reserves in the Lake includes about 18 500 m^3 of white diatomite along the perimeter and 11 550 m^3 of soft medium brown grey sediment in the deeper centre of the Lake.

Webbs Lake, Cumberland County

This small Lake is located 3 km north of Sutherland Lake, and 5 km south of Cross Road Mountain. Access is by a logging road about 1.6 km northwest of Sutherland Lake. The diatomite covers an area of 3.6 ha of the 5 ha Lake and averages 0.5 m in depth, thinning towards the margin. A water

level of 1.5 m is currently maintained by a beaver dam on the Lake's western end. It is estimated that approximately 18 000 m^3 of in situ diatomite of two grades is present. The upper material is dense, grey white to light tan in colour and the lower material is more organic, dark grey in colour and poorly consolidated. Estimates of dry crude reserves based on moisture content and loss on ignition suggest that upon calcining there would be potential for 4000 t of calcined product from the pure diatomite and a further 2900 t in situ from the more organic material of the lower strata.

Conkey Pond, Colchester County

This small deposit is located just south of Gards Pond about 1.5 km east of the Truro road, and about 6 km south of East New Annan, Colchester County. It is overlain by 0.5-1 m of water. The deposit was one of the areas mined in the early part of this century. Trenching and other signs of previous work indicate that possibly half of the original deposit has been removed. The diatomite is pure white, although some iron staining was detected associated with roots penetrating the surface of the sediment. The diatomite is 20-50 cm thick over an area of 0.5 ha indicating a potential for 1750 m^3 of crude diatomite in situ. Moisture content at 52 per cent indicates a potential of 1000 t of dry crude diatomite in situ that could be used as a natural powder or calcined. A potential 930 t of calcined product is estimated to be in situ.

Gamble Lake Pond, Colchester County

This deposit is located just south of Gamble Lake, Colchester County, about 1 km east of the Old Castlereagh Road, 9 km north of Portapique Mountain. The diatomite occurs beneath about 1 m of water in a small pond about 2.3 ha in size. It is found to cover the majority of the Pond bottom to a depth of 0.5 to 1 m and is overlain by 20 cm of soft grey-brown peaty gyttja that deepens towards the western side of the Pond. A small swamp and floating bog area occur along the margins of the Pond and the diatomite thins out beneath these areas. It is estimated that there is 10 000 m^3 of crude diatomite over an area of 2.0 ha in the Pond. Analyses of samples from the deposit show that there is a potential for 12 200 t of dry crude or 10 150 t of calcined product in situ.

Table 3. Preliminary estimates of several diatomaceous earth deposits in Nova Scotia.

Deposits	Estimate of Reserves		
	In situ Volume (m^3)	In situ Tonnage (t) dry crude (%SiO_2)	In situ Tonnage (t) sintered (%SiO_2)
Brora Lake			
organic	350 000	40 000 (67%)	29 400 (92%)
white	20 000	4 400 (77%)	3 370 (92%)
Factory Bog			
organic	400 000	73 200 (63%)	53 400 (86%)
McCuish Lake			
organic	115 200	44 900 (69%)	37 300 (88%)
white	18 500	8 400 (74%)	7 200 (86%)
Webbs Lake			
organic	8 600	2 300 (79%)	2 950 (92%)
white	9 100	4 500 (84%)	4 000 (94%)
Conkey Pond			
white	1 750	1 000 (89%)	930 (97%)
Gamble Pond			
white	10 000	12 200 (78%)	10 150 (99%)

SUMMARY

Diatomite occurrences can be found throughout Nova Scotia, but there are few of economic significance. Six deposits with the most potential have been outlined indicating 147 700 t of finished product in situ from 900 000 m^3 of material. The material assessed to date has shown that there is a fairly high organic load and moisture content. Gamble Lake Pond, Webbs Lake and Conkey Pond deposits may however, have reserves that would not require substantial calcining or processing.

MINERAL RIGHTS

Diatomite is a Crown mineral in Nova Scotia. Claims for exploration and development are administered through the Nova Scotia Department of Mines and Energy.

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Halifax, Nova Scotia
1988

Nova Scotia Department of Mines and Energy, Information Circular No. 17

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